1996

6(a) (i) $f = \omega^2 x$

$20 = \omega^2 (0.8)$

$\Rightarrow \quad \omega = 5$ rad/s 5

no. of oscillations per minute $= 60 \dfrac{\omega}{2\pi}$

$= \dfrac{150}{\pi}$ or 47.7 5 10

(ii) $v = \omega \sqrt{a^2 - x^2}$

$2 = 5 \sqrt{a^2 - 0.64}$

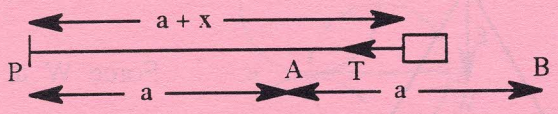
$\Rightarrow \quad a = \sqrt{0.8}$ or 0.89 m 5 5

(iii) max. $f = \omega^2 a = 25\sqrt{0.8}$ 5

Force $= m f$

$= 250\sqrt{0.8}$ or 223.6 N 5 10

(b) (i)



Force in dirn of x inc $= -T$

$= -kx$ 5

acceleration $= -\dfrac{k}{m} x$

Therefore S.H.M. about $x = 0$ with $\omega = \sqrt{\dfrac{k}{m}}$ 5 10

(ii) time to travel from B to A $= \dfrac{\text{Period}}{4}$

$= \dfrac{2\pi}{4\omega} = \dfrac{\pi}{2}\sqrt{\dfrac{m}{k}}$ 5

velocity at A $= \omega a$ 5

time to travel from A to P $= \dfrac{\text{distance}}{\text{velocity}}$

$= \dfrac{a}{\omega a} = \sqrt{\dfrac{m}{k}}$

$\Rightarrow$ total time $= \left(\dfrac{\pi}{2} + 1\right)\sqrt{\dfrac{m}{k}}$ 5 15